THE PULSE OF THE INSANE.

BY EDWARD R. HUN, M. D.,

SPECIAL PATHOLOGIST OF THE NEW YORK STATE LUNATIC ASYLUM, AT UTICA.

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Before examining the results of investigations made upon the pulse of the insane, it might be well to consider the physiological pulse as traced by the sphygmograph, and also to determine some of the changes which it undergoes in consequence of morbid conditions not attended by psychical phenomena.

The normal pulse trace as obtained by the sphygmograph of Marey, consists of an upright or vertical line terminating in a moderately sharp point, and followed by a gradual line of descent, which latter line is broken into waves or undulations at two points. Such a trace is

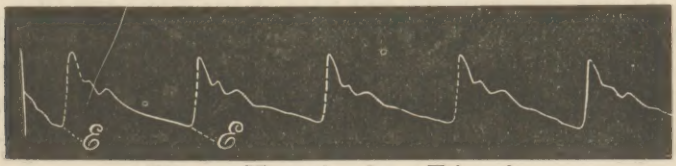


Fig. 1. Normal pulse. Tricrotic.

represented in figure 1, and in consequence of its having three apices it is termed *tricrotic*.

If we discard the various forms of cardiac disease as foreign to this paper, we may state that the most frequent and interesting of the many metamorphoses which the pulse undergoes, are these which accompany febrile action, and one of the most important of these is an in-

creased rapidity. As the temperature of the body rises, the pulse becomes more frequent, and at the same time assumes a different form.

In order to explain this change we will find it convenient to give a name to the various portions of the trace, and therefore we call the apex formed by the upper extremity of the line of ascent, in the normal type, and the commencement of the line of descent, the great or primary wave and the two undulations which interrupt the line of descent, the first and second secondary waves respectively.

Now as the pulse becomes more frequent we find the first secondary wave diminishing in size, and at a temperature of about 104°, when the pulse varies between 100 and 120 per minute there remain only two apices to each pulse curve, the first secondary wave having entirely disappeared, and in place of the *tricrotic* or normal pulse we have the *dicrotic* or characteristic fever pulse.

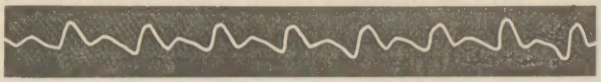


Fig. 2. Fever pulse. Dicrotic.

As the temperature and rate of the pulse increases we have yet another modification of the pulse curve. The second secondary wave diminishes and finally disappears at a temperature of 106° and a pulse of 140 per minute, and the result is such a trace as is represented in figure 3, where both secondary waves have disappeared, and only a single apex is observed. This pulse is termed

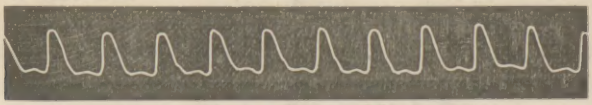


Fig. 3. Fever pulse. Monocrotic.

monocrotic. Between these marked metamorphoses we find intermediate types where the pulse trace is termed *sub-dicrotic*, (fig. 4,) and *super-dicrotic*, (fig. 5.)

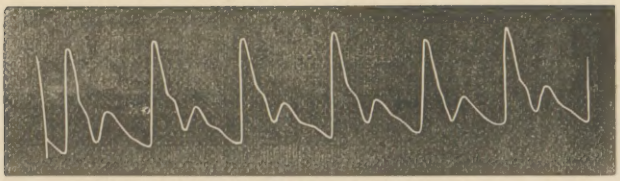


Fig. 4. Fever pulse. Sub-dicrotic.

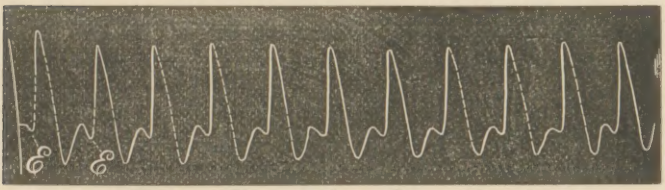


Fig. 5. Fever pulse. Super-dicrotic.

The principal modifications of the pulse curve therefore consist in a deviation from the *tricrotic* to the *dicrotic* or *monocrotic* type in ordinary forms of disease, and such deviation from the normal standard is accompanied by an increase not only in the rate of the pulse but also in the temperature of the body. Hence, there exists a certain harmony between the temperature and the rapidity and form of the pulse. This harmony holds good in cases of depression as well as of exaltation of temperature, for in cases of algidity such as are sometimes found during convalescence from acute fevers, where the temperature falls below the normal standard, the rate of the pulse is diminished and at the same time the sphygmographic curve becomes more decidedly tricrotic than in health.

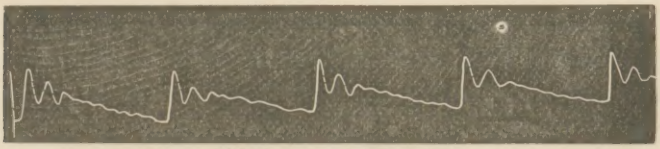


Fig. 6. Algid pulse.

It has been found by Wolff, and is so stated by him, that "when this harmony between the temperature and the pulse is so interfered with that an elevation or

depression of temperature is not accompanied by a corresponding alteration of the pulse curve, we have a disease or a period of a disease in which the central nervous apparatus is implicated to an unusually great and dangerous extent. Thus we find in febrile diseases of the nervous system a loss of parallelism between the temperature and the pulse, as is often manifested by the rate of the latter."

The same author finds, and my own investigations fully confirm his statements, that in the insane this loss of parallelism between the pulse and temperature is destroyed, and furthermore, that the form of the pulse curve is fundamentally altered. The trace no longer presents a series of acute apices, as in the normal or febrile pulse, but each curve is surmounted by a horizontal line or flat top, and assumes the form described by Marey as the senile pulse.

Before entering more minutely into the study of the pulse trace of the insane, I may with propriety mention, that in persons who suffer from psychical derangement, the bodily temperature differs but little if any from the normal standard, except in cases where there is some intercurrent disease, and as a general rule an elevation of temperature above 100° indicates the existence of some complicating disease which does not directly depend upon the insanity. The temperature of intercurrent febrile diseases in the insane runs the same course as in the same diseases in the sane, and under these circumstances the pulse undergoes such modifications that in some instances an insane patient who has when apparently in good physical health presented a pathological pulse trace, may under the influence of febrile reaction produce a curve which closely resembles the normal *tricrotic* pulse of the sane.

The pathological pulse of the insane always tends

toward the *dicrotic* or *monocrotic* type, being never *tricrotic* in uncomplicated cases. It becomes more characteristic as the mental condition degenerates, and assumes its typical form in the most profound state of dementia. The following traces which I obtained from patients in this Asylum, will serve to demonstrate the pulse curves so found in the different forms of insanity.

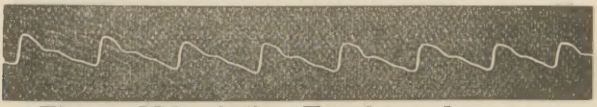
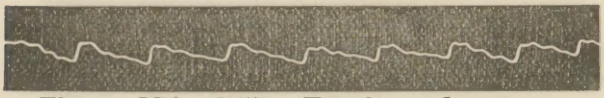


Fig. 6. Melancholia. Female, aged 38 years.



Fig, 7. Melancholia. Female, aged 28 years.

Fig. 8. Melancholia. Male, aged 48 years.

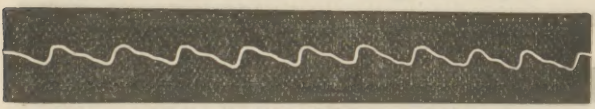


Fig. 9. Melancholia. Male, aged 51 years.

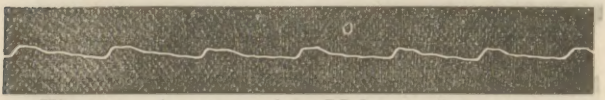


Fig. 10. Acute mania. Male, aged 40 years.

Fig. 11. Acute mania. Male, aged 28 years.

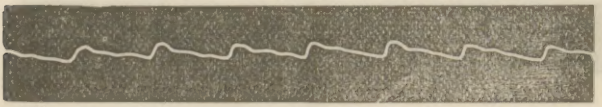


Fig. 12. Sub-acute mania. Male, aged 26 years.

Fig. 13. Paroxysmal mania. Female, aged 30 years. Subsequently died of apoplexy.

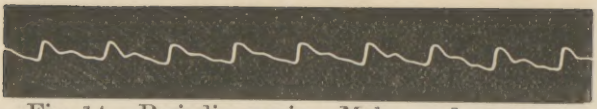


Fig. 14. Periodic mania. Male, aged 51 years. Taken while he was recovering from an attack.

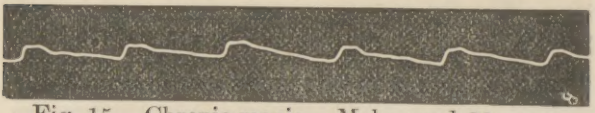


Fig. 15. Chronic mania. Male, aged 36 years.

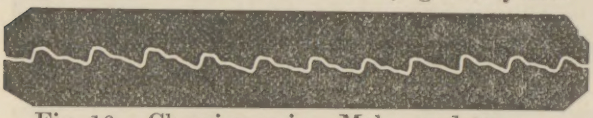


Fig. 16. Chronic mania. Male, aged 60 years.

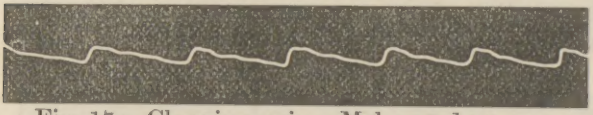


Fig. 17. Chronic mania. Male, aged 38 years.

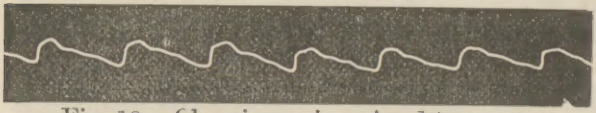


Fig. 18. Chronic mania. Aged 78 years.

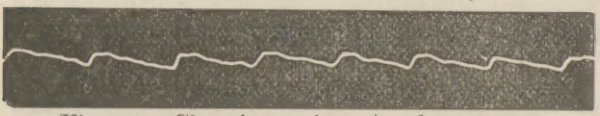


Fig. 19. Chronic mania. Aged 50 years.

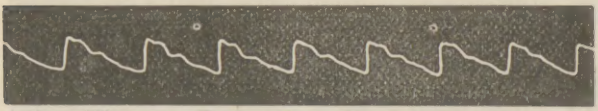


Fig. 20. Dementia. Aged 18 years.

Fig. 21. Dementia. Aged 45 years.

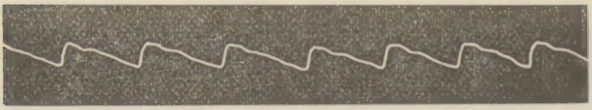


Fig. 22. Dementia. Aged 37 years.

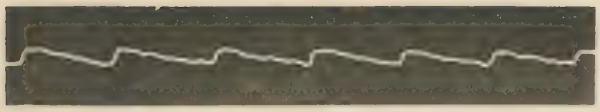


Fig. 23. Dementia. Aged 34 years.

Fig. 24. Dementia. Aged 40 years.

An analysis of the above traces shows two points of difference between them and the normal type: 1st, a loss of *tricrotism* with a marked tendency to the *dicrotic* and *monocrotic* form, and 2d, a flat top in place of the acute angle found in health and febrile diseases. The first of these changes we have already found to exist in cases of fever when the temperature of the body is elevated, but among the insane there is no increase of temperature, and we may therefore consider a dicrotic pulse unaccompanied by an abnormal rise of temperature as one of the physical phenomena of insanity.

The second deviation from the normal standard is still more characteristic of psychical disorder. This peculiar pulse curve with a flat summit has been described by Marey, and attributed by him to a pathological condition of the arterial walls, whereby their elasticity was diminished and an impediment offered to the free flow of blood. Now in the examples of this form of pulse which he figures in his work upon the circulation of the blood, Marey states that his patients were inmates of the Bicêtre and Salpêtrière, which asylums contain for the most part insane, demented and paralytic persons. Consequently, we are as fully justified in considering the alteration of the pulse curve due to the condition of the nervous system, as we are in attributing it to a pathological state of the walls of the arteries.

Moreover, I am fortunately able to furnish pulse traces of two patients who have fallen under my observation, in which Marey's results are directly contradicted.

Fig. 25, represents the pulse of a patient aged 60 years, who presented upon physical examination all the characteristic symptoms of structural change in the heart and arteries. Angina pectoris, dyspnœa, and a condition of the radial arteries which communicated to the finger, a sensation as if they were firm, inelastic cords, were symptoms which I frequently had occasion to observe,

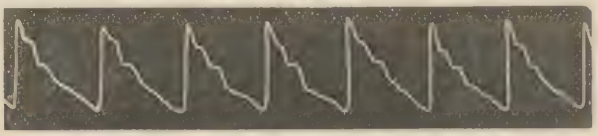


Fig. 25. Male, aged 60 years.

and yet the trace has an acute apex, and is distinctly *tricrotic.*

Fig. 26, on the other hand, is the pulse of a patient who was hemiplegic, and presented symptoms of mental derangement resulting from an apoplectic attack, and in whom neither auscultation or palpation revealed any

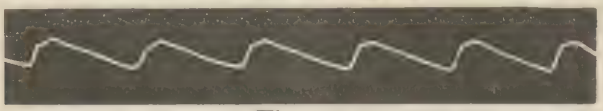


Fig. 26.

abnormal condition of the heart or arteries, and yet we find a flat-topped monocrotic pulse curve.*

* Note.—I do not intend to be understood as denying that an atheromatous condition of the arteries may not be accompanied by a pulse which gives a trace similar to that seen in fig. 26, but I think that in these cases the same defective nutrition which causes the change in the walls of the blood-vessels may also interfere with the proper reparation of nerve tissue, and thus influence the form of the pulse. In fact, a diseased condition of the nutrient vessels of the brain is one of the most frequently observed facts in cases of paralysis and mental disorders, and it may be that the alteration

If we examine the traces represented in figs. 12, 15, 17 and 22, we find the well marked senile pulse of Marey, while the age of the patient contraindicates atheromatous degeneration, and we are therefore compelled to seek some other explanation of the phenomenon, the key to which, I think, can only be found in the sympathetic nervous system.

The disordered condition of the ganglionic system in the insane, is evidenced by such marked symptoms that it would be indeed surprising if we did not find a pathological condition of the pulse. The sluggish circulation through the peripheral capillaries is rendered evident by the passive congestion of the hands and feet, and the white line bordering the edge of the lip, observed both in melancholia and mania, and attains its maximum when the patient relapses into the most profound dementia; the frequent attacks of local hyperæmia, which in some cases are sufficiently intense to result in rupture of the vessels, and to produce that remarkable appearance known as *hæmatoma auris*, can only be attributed to the disordered action of the sympathetic system, while the altered condition of all the secretions, both cutaneous and intestinal, must be referred to the same agency. Again, the defective nutrition of the insane is but the index of some unknown cause, influencing the functions of organic life through the medium of the sympathetic ganglia.

Comparatively recent investigations of physiologists have demonstrated that the centres of the great sympathetic are situated in the *crura cerebri*, and pass downward along the central axis of the cord. From these centres fibres radiate toward the periphery of the body

of the nervous tissue is due to the disease of the vessels, and that the pathological pulse is therefore the result of the combination of two elements, which are related to one another as cause and effect.

in close contact with the fibres of the cranial and cerebro-spinal nerves, which they accompany for a short distance, and then branch off to supply the walls of the blood vessels, over which it is their special functions to preside. Other fibres again pass into the gray matter of the hemispheres, and are intimately connected with the nerve cells occupying the cerebral convolutions. Hence, it results that the sympathetic nerves may be influenced not only by external agents acting upon their peripheral extremities, but also by emotional causes influencing their centripetal prolongations. In fact the experiences of daily life continually offer examples of this mode of irritation, the emotions of fear, anger and shame all give rise to external phenomena with which we are familiar, as pallor of the countenance, blushing, &c., &c.

In insanity, when the cerebral activity is far greater than in health, and where a constant flow of the most dissimilar ideas passes through the mind in rapid succession, each in turn calling forth some emotional excitement, the sympathetic centres are subject to continual excitation, and by reflex action manifestly influence the phenomena of the circulation. This centripetal irritation, when continued for a certain time, wears out the excitability of the ganglia, and results in a paralysis of the nerve filaments supplying the circulatory apparatus, in consequence of which, we find a passive dilatation of the smaller arteries and capillaries, with a loss of the normal elasticity of their walls. The free flow of blood from the arterial to the venous system is interfered with, and the result is a sluggish, monocrotic form of pulse. It is not unlikely that cardiographic tracings of the action of the heart itself would show a deviation from the normal rythm, so that the insane pulse may depend not only upon the abnormal condition of the vessels, but also in some degree upon functional disturbance of the cardiac contractions.

In conclusion, I will give a few traces borrowed from Wolff, which corroborate the opinion expressed above with regard to the action of emotional excitement upon the form and rythm of the pulse.

Figure 27, represents the pulse of a patient having

Fig. 27. Chronic Mania.

chronic mania during a condition of bodily and mental repose, while figure 28 shows the modification of the

Fig. 28.

pulse curve caused by the patient's having a strong desire to ask a question.

Figure 29, is the pulse of a patient who exhibited

Fig. 29. Mania.

slight symptoms of mania, and who presented the pulse trace shown in figure 30, under the influence of excite-

Fig. 30.

ment caused by a desire to complain of bad treatment. As he became still more angry his pulse assumed the form represented in figure 31, and finally being no longer

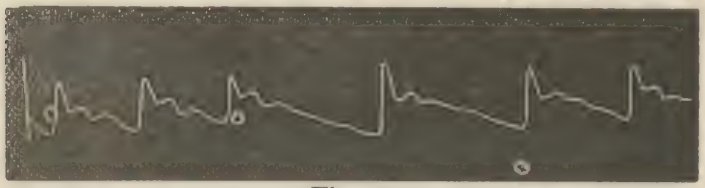


Fig. 31.

able to restrain himself, he broke out in a storm of words, and gave the trace figured in figure 32.

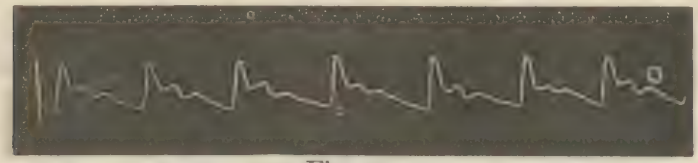


Fig. 32.

In the last case we find that emotional excitement not only influences the form of the pulse, changing it from the *dicrotic* to the *tricrotic* type, but it also modifies the cardiac rythm, and produces a kind of intermittence, which continues during the effort to restrain the feelings, and resumes its regular rate as soon as the patient finds relief in an outburst of passion.

From the above, I am of the opinion that in the earliest stage of insanity, when the mental agitation is most acute, we should expect to find a pulse nearly approaching the normal tricrotic type, and in proportion as the excitement diminishes and the patient falls into a state of mental apathy and dementia, the pulse becomes *dicrotic*, and at last *monocrotic*, sluggish and flat-topped, as a result of the loss of irritability or paralysis of the great sympathetic system.